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(54) Dose indicator for inhalers.

(57) An indicator unit for giving an indication to an asthma sufferer when he is about to use an asthma inhaler. The indicator unit comprises a case for holding the inhaler, a switch operated by use of the inhaler, a timing circuit and an indicator means. The timing circuit is pre-programmed with the recommended dosage regimen and gives an indication via the indicator means as to the advisability of taking a current dose.

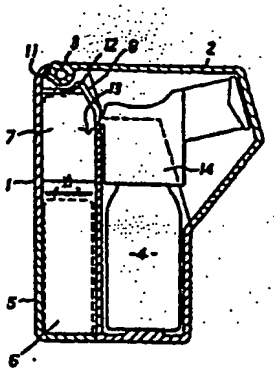

FIG. 1

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"DOSE INDICATOR FOR INHALERS"

The invention relates to an indicator arrangement which is used in conjunction with inhalers for asthma relief. The drugs used for asthma relief are powerful and users are warned to restrict the dosage. However, it is sometimes difficult for a patient, a parent or a doctor to keep accurate count of the number of doses taken over a particular period. The invention seeks to provide an automatic indicator for this purpose.

According to the invention there is provided an indicator unit, the unit comprising a case adapted to house an asthma inhaler in such a way that the inhaler can be used without removal from the case; a timer switch mounted in the case so as to be actuated each time the inhaler is used; and, also mounted in the case, a timing circuit programmed in accordance with a predetermined dosage regimen, indicator means, and a battery, the timing circuit being responsive to operation of the switch and being effective to give an output to the indicator means which takes into account the time, the recent usage of the inhaler, and the predetermined dosage regimen, to indicate the advisability of a current dose.

The time circuit may be composed of discrete circuit components and the required programm may be determined by the values of specific components of the circuit. Alternatively, micro-computer techniques may be employed and the timer circuit may comprise a pre-programmed, and perhaps a re-programmable, micro-computer integrated-circuit.

The invention is applicable to the various kinds of inhalers which are available. For example, the inhaler may be of the type which dispenses a dispersal of liquid or dry powder. The drug may be dispersed and drawn in by sucking action or it may be contained in a pressurized aerosol dispenser or other means mechanical or electronic to atomise the drug. Aerosols may be actuated by manual depression of the spray head, by mechanical means of pushing the aerosol and spray head together, or by a pressure-responsive device which acts when the sufferer draws at the mouthpiece.

In inhalers which are actuated manually the timer switch is conveniently coupled to be operated by depression of the spray head. With pressure-actuated inhalers a pressure-responsive switch may be fitted at the mouthpiece.

The indicator means may be an audible indicator but preferably it is a visual display. The display may be digital, using light-emitting diodes (L E D 's) or liquid crystal devices (L C D 's). Alternatively, the display may be in coded form using flashing and/or coloured lights conveniently L E D 's.

A difficulty with L E D displays in particular is that there is a significant battery drain when the display is illuminated.

Thus, preferably the display is illuminated only on demand, perhaps by a manual switch but preferably automatically by a switch coupled to the lid.

It is preferable for the timer circuit to have a memory which allows the dosage to be totalled over,

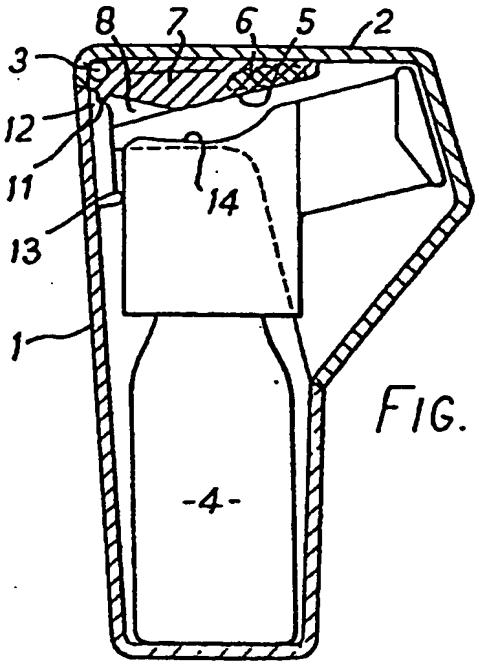
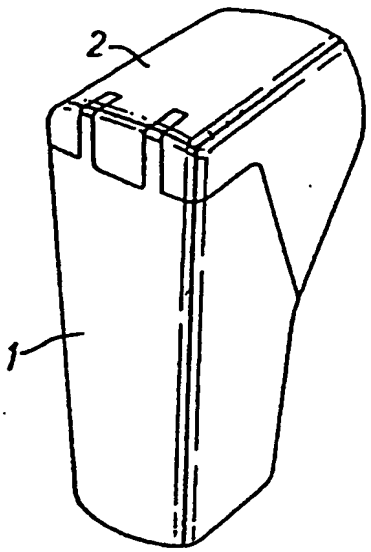


FIG. 6

FIG. 7



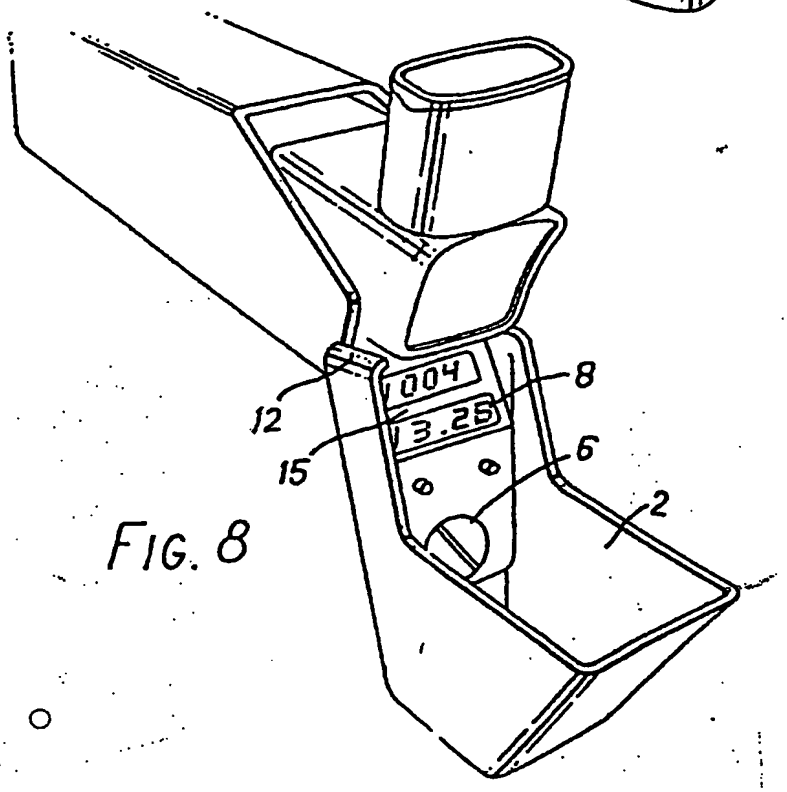


FIG. 8

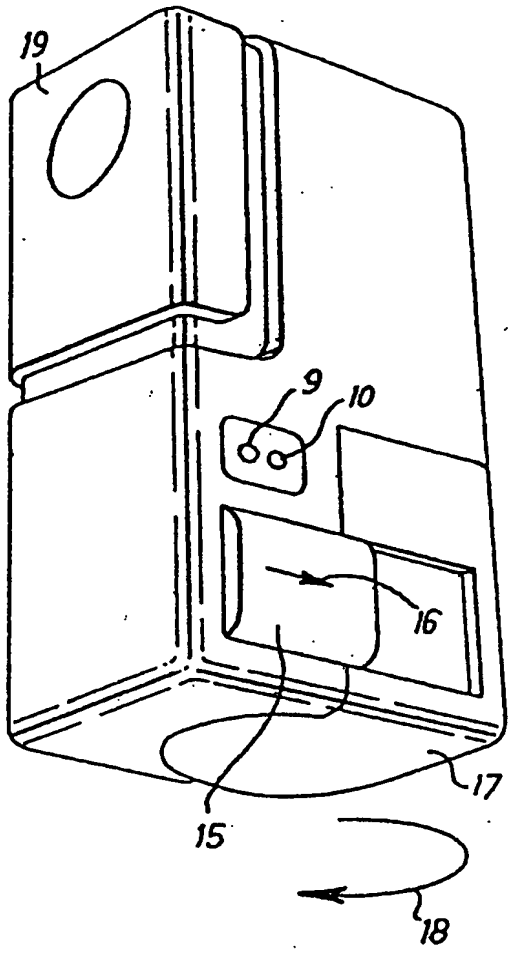


FIG. 4

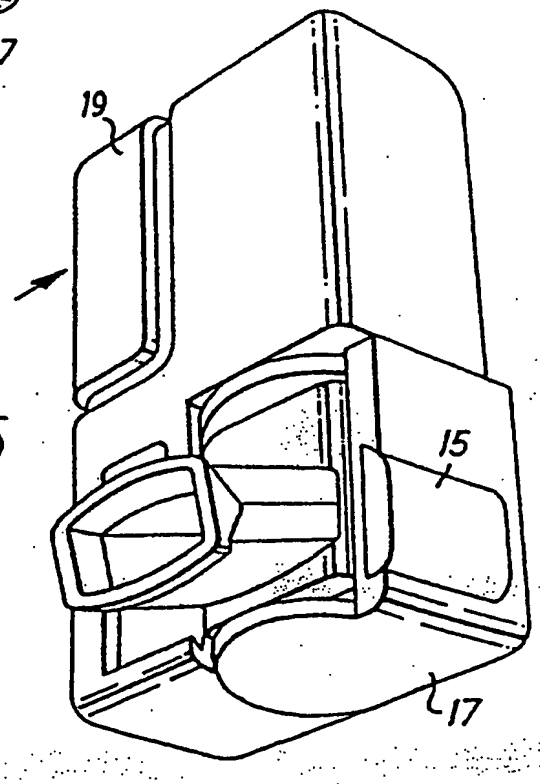


FIG. 5

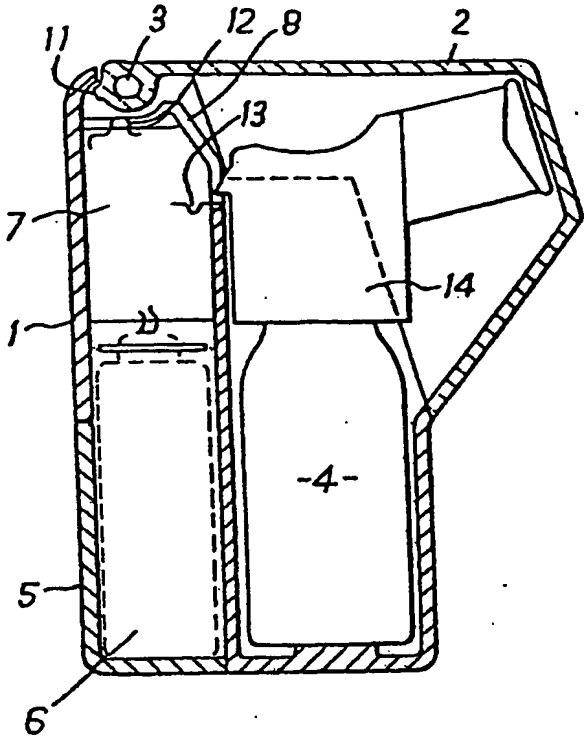
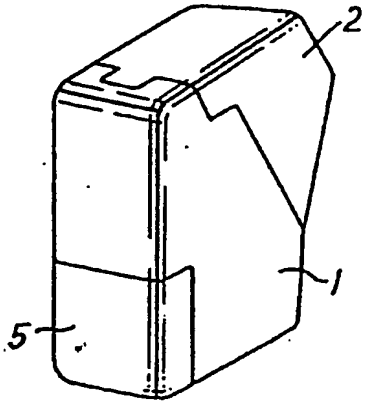


FIG. 1

FIG. 2



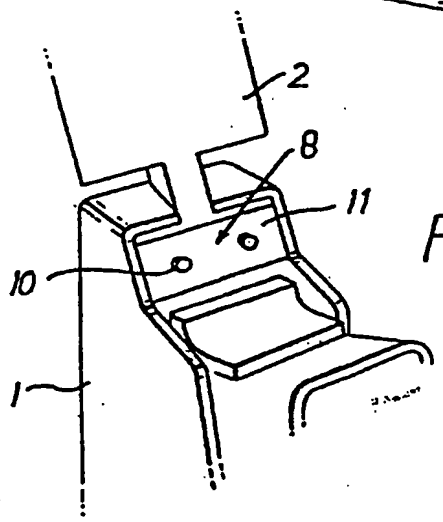


FIG. 3

extinguishing the display a predetermined time after the lid has been opened.

6. An indicator unit as claimed in any of the preceding claims wherein the timercircuit includes a memory which allows the dosage to be recorded over at least 24 hours.

7. An indicator unit as claimed in claim 6 wherein the memory allows the dosage to be recorded over at least 16 days.

8. An indicator as claimed in claim 7 wherein the memory is non-volatile.

9. An indicator unit substantially as herein-before described with reference to Figures 1 to 3, 4 and 5 or 6 to 8 of the accompanying drawings.

CLAIMS:

1. An indicator unit, the unit comprising a case adapted to house an asthma inhaler in such a way that the inhaler can be used without removal from the case; a timer switch mounted in the case so as to be actuated each time the inhaler is used; and, also mounted in the case, a timing circuit programmed in accordance with a predetermined dosage regimen, indicator means, and a battery, the timing circuit being responsive to operation of the switch and being effective to give an output to the indicator means which takes into account the time, the recent usage of the inhaler, and the predetermined dosage regimen, to indicate the advisability of a current dose.

2. An indicator as claimed in claim 1 wherein the indicator means gives a visual display in coded form using flashing and/or coloured lights.

3. An indicator as claimed in claim 1 wherein the indicator means gives a digital display.

4. An indicator as claimed in any of the preceding claims wherein the case has a lid which must be opened before the inhaler can be used and a second switch is positioned to be operated when the lid is opened, the indicator means being operated to give a display by operation of the second switch.

5. An indicator unit as claimed in claim 4 wherein the timer circuit includes means for

A suitable micro-processor for the timing circuit of the embodiment of Figures 6 to 8 is that marketed by ITT semiconductors under the designation SAA 6000. This is a mask programmable device which can be thus programmed with the dosage regimen to give any required form of output - including audible.

taken over the recommended limit can be displayed digitally in a repeat form or series of flashes or by use of a flashing symbol. In all options it is possible to provide a perpetual clock and to indicate timing between doses or time when last dose was taken or when it is reasonable to take another dose. Digital or symbolic information would however preferably be quite simple for the patient to understand but the doctor or clinician may wish to have access to more detailed information concerning number of doses taken, sequence and so on with immediate daily totalisation and daily totals on a sequential basis. It is also possible to provide information by means of an audible electronic speaking voice. The L C D electronic method would provide immediate visual access to the memory without the need to plug in for an external digital display. The unit however could be produced with a socket from which, by means of a plug and lead, a print-out could be made of the information contained in the memory. This would be of particular value to the clinician.

The unit of Figure 8 has the L C D panel 15 visible when the mouthpiece or lid 2 cover is opened. The unit is then made ready for use by closing contacts of microswitch 12 and the display is switched on. In order to reduce consumption of power the L C D display will be automatically switched off after a predetermined period of time and can be reinstated by closing and re-opening the mouthpiece cover.

arrow 18. This brings the inhaler nozzle to a position ready for use and switched on the L E D display. The inhaler is actuated by squeezing a side portion 19 of the casing. This portion may be swung outwardly for battery replacement.

Referring to Figures 6, 7 and 8, the indicator unit comprises a case, timer circuit, switches and display, etc, which have the same designations as in the embodiments of Figures 1 to 5. In the present embodiment, however, the visual display 8 consists of an L C D panel giving up to eight digit information with up to eight special symbols if required.

The maximum safe dosage is usually determined by the drug manufacturer, the L C D method however will provide digital or graphical information which can be related to precise instructions given by the doctor or clinician.

In this embodiment the timer circuit comprises a pre-programmed micro-computer integrated circuit. A large number of alternative digital, graphical, symbolic and audible messages can be provided giving precise information to the patient, doctor or clinician. For example and in accordance with the alternative L C D system the display panel could be given a two colour image in which case digital information on doses taken within the three hour period would be displayed on one colour section and doses taken over the normal three doses every 3 hour regimen would be displayed on the other different colour section. Alternatively information concerning doses

every three hours, although this may be determined by the drug manufacturer. The timer circuit is programmed to operate to show a limit signal within a predetermined dosage regimen. For example, for a dosage of three doses every three hours the indications would be in accordance with the following code:

If no doses have been taken in the last three hours, the green L E D gives a sequence of three-flash bursts, showing that up to three doses may be taken. If one dose has been taken in the last three hours, the green L E D gives a sequence of two-flash bursts. If two doses have been taken in the last three hours the green L E D gives a sequence of single spaced flashes. If three doses have been taken in the last three hours the red L E D is illuminated, either continuously or in flashes, to indicate the advisability of taking further doses.

A further indication is given when the restriction is about to be released, say fifteen minutes beforehand. Then the green L E D is illuminated in conjunction with the red L E D, in alternate flashes.

The timer circuit has a memory which stores the number of doses taken in say 16 days. This can be tapped for digital indication by means of a plug and socket (not shown).

The unit of Figures 4 and 5 has the L E D's 9 and 10 visible externally. The unit is made ready for use by sliding a catch 15 across in the direction of arrow 16. A cover 17 is then swivelled in the direction of

Figure 4 is a perspective view of a second form of the indicator unit according to the invention;

Figure 5 is a perspective view of the unit of Figure 4 ready for use;

Figure 6 is a sectional elevation of another indicator unit according to the invention;

Figure 7 is a perspective view of the unit of Figure 6; and

Figure 8 is a view showing the display of the unit of Figures 6 and 7.

Referring to Figure 1 the indicator unit comprises a plastics casing having a body 1 with a lid 2 hinged at 3. The casing houses the drug container which is an aerosol 4 which may be removed and replaced when exhausted. The body 1 has a sliding cover 5 which allows a battery 6 to be inserted. A timer circuit 7 of discrete components is included and this operates a visual display 8 consisting of a red L E D 9 and a green L E D 10.

The lid 2 is provided with a detent 11 which, when the lid is opened, closes contacts of a microswitch 12. This allows the display to be connected to the timer circuit. Otherwise, the display is not connected. A timer microswitch 13 is positioned to be operated when the spray head 14 of the inhaler 4 is depressed to dispense a dose. The timer circuit registers the operation of the switch 13 and has memory which, in conjunction with an electronic timer, determines the number of doses dispensed in the recent past. The usual maximum safe dosage is generally considered to be three doses

say, twenty-four hours. Furthermore, it is convenient if the memory allows totalisation of dosage over, say, 16 days. Preferably, therefore, the memory is non-volatile, so that should the battery be disconnected from the circuit between doses the information is not lost. With this arrangement the display switch becomes a battery switch which connects the display to the battery only when required.

The above-described facility for relatively long-term storage of dosage is useful for purposes of clinical analysis, for example for evaluation of the efficiency of a particular drug. The patient, the clinician and the doctor will have access to this information which can be L C D or L E D. In the case of L E D the doctor or clinician may connect a digital display device, or print-out device, which taps the long term memory and presents the information sequentially in 24 hours totals or in graphic form. In the case of L C D the information is immediately available on the unit in the same sequential manner by means of a switch.

The invention will further be described with reference to the accompanying drawings, of which

Figure 1 is a sectional elevation of an indicator unit according to one embodiment of the invention;

Figure 2 is a perspective view of the unit of Figure 1;

Figure 3 is a view showing the display of the unit of Figures 1 and 2;